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CLAIMS

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(57) [Claim(s)]

[Claim 1] The stator manufacturing installation which is characterized by providing the following and which twists two or more electric conductors (3, 31, 32) which begin to be prolonged in accordance with shaft orientations from the end face of an annular stator core (1). The edge (31d, 31e, 32d, 32e) of the aforementioned electric conductor (3, 31, 32) is held, and it is the plastic surgery section (54) which can move relatively [ shaft orientations / a hoop direction and ] about an aforementioned stator-core (1) and same axle top. The hoop-direction mechanical component which drives the aforementioned plastic surgery section (54) to a hoop direction (541a-544a) The shaft-orientations mechanical component which drives the aforementioned plastic surgery section (54) to shaft orientations (54a, 54b)

[Claim 2] The aforementioned electric conductor (3, 31, 32) is a stator manufacturing installation according to claim 1 characterized by forming two or more layers in the direction of a path in the aforementioned slot (2), arranging the aforementioned plastic surgery section (54) on the same axle, and having relatively two or more twists fixture (541-544) which can rotate.

[Claim 3] The aforementioned twist fixture (541-544) is a stator manufacturing installation according to claim 2 characterized by the ability to rotate in any direction of a hoop direction.

[Claim 4] The stator manufacturing installation according to claim 2 or 3 characterized by providing the following. In two or more aforementioned twist fixtures (541-544) the edge (31d and 31e -- 32d) of the aforementioned electric conductor (3, 31, 32) The aforementioned attaching part which the attaching part (541b, 542b, 543b, 544b) which 32e is inserted and holds the aforementioned electric conductor (3, 31, 32) is drilled, and was drilled by the twist fixture (541-544) of the above 1 (541b, 542b, 543b, 544b) The septum which prevents a free passage with the aforementioned attaching part (541b, 542b, 543b, 544b) formed in other twist fixtures (541-544) which adjoin in the twist fixture (541-544) and the direction of a path of the above 1 (541c-544c, 542d, 543d)

[Claim 5] Two or more aforementioned twist fixtures (541-544) adjoin in the direction of a path, and contain the aforementioned twist fixture (541-544) of a \*\*\*\*\* couple. The aforementioned septum (541c-544c) located between the aforementioned attaching parts (541b, 542b, 543b, 544b) of the aforementioned twist fixture (541-544) of these couples The stator manufacturing installation according to claim 4 characterized by having thickness smaller than the aforementioned septum (542d, 543d) located between the aforementioned attaching parts (541b, 542b, 543b, 544b) of the two aforementioned twist fixtures (541-544) which do not make a pair although it adjoins in the direction of a path.

[Claim 6] Two or more aforementioned twist fixtures (541-544) are stator manufacturing installations according to claim 5 characterized by having two or more pairs of aforementioned twist fixtures (541-544) which adjoin in the direction of a path.

[Claim 7] The stator manufacturing installation of any one publication of a claim 1 to the claim 6 characterized by having further the controller (55) which controls operation with the aforementioned hoop-direction mechanical component (541a-544a) and the aforementioned shaft-orientations mechanical component (54a, 54b).

[Claim 8] It is the stator manufacturing installation of any one publication of a claim 2 to the claim 6

which is further equipped with the controller (55) which controls operation with the aforementioned hoop-direction mechanical component (541a-544a) and the aforementioned shaft-orientations mechanical component (54a, 54b), and is characterized by the aforementioned controller (55) rotating relatively the aforementioned twist fixture (541-544) which adjoins in the direction of a path.

[Claim 9] To the annular stator core (1) in which many slots (2) were prepared together with the hoop direction The segmented electric conductor (3, 31, 32) is arranged so that two or more layers may be formed in the direction of a path in the aforementioned slot (2). To the bay of the aforementioned electric conductor (3, 31, 32) which has come out of the aforementioned slot (2) by the side of one edge of the aforementioned stator core (1) The edge of the aforementioned electric conductor (3, 31, 32) is held preparing the aforementioned electric conductor (3, 31, 32) and crevice which adjoin in the direction of a path. The stator manufacture method characterized by moving relatively [ shaft orientations / a hoop direction and ], twisting to the aforementioned stator core (1), and joining and flowing through the edges (31d, 31e, 32d, 32e) of the aforementioned electric conductor (3, 31, 32).

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] Especially this invention is applied to the twist equipment of the stator coil of the AC generator for vehicles carried in a passenger car, a truck, etc. about a stator manufacturing installation.

[0002]

[Description of the Prior Art] In order to respond to the request of the high increase in power of the AC generator for vehicles conventionally, the electric conductor with which the shape of U character was segmented by two or more slots prepared in the stator core is inserted from the same, and what forms a stator winding is proposed by joining them. With this composition, since the electric conductor with which the shape of U character was segmented can be put in order regularly, the electric conductor within a slot can be formed into a high space factor, and a high increase in power becomes possible.

[0003] In order to form a stator coil from the electric conductor with which plurality was segmented, it is necessary to join the edge of an electric conductor to the edge of other electric conductors. In the international public presentation/[ 92nd ] No. 06527 pamphlet (1992), two or more electric conductors inserted in the stator core are joined, and the process which forms a stator coil is shown. With the above-mentioned conventional technology, every two electric conductors are inserted in the inner circumference [ within one slot 2 ], and periphery side like drawing 9 , respectively. And as shown in drawing 10 , each bay of the electric conductor 131 by the side of the periphery which came out of the end of the slot 2 of a stator core 1, and the electric conductor 132 by the side of inner circumference is mutually bent by the hoop direction by the half-pole pitch with the twist fixtures 154a and 154b at a retrose. And the stator coil is formed by joining the edges of the electric conductor which adjoins in the direction of a path in the state where it was bent by the half-pole pitch.

[0004]

[Problem(s) to be Solved by the Invention] however, with the above-mentioned conventional technology, since the twist fixtures 154a and 154b are performing only movement of a hoop direction, electric conductors 131 and 132 escape from them with rotation from electric conductor hold section 154c of the twist fixtures 154a and 154b. In order that electric conductors 131 and 132 may fall out with the twist, bending R of the entrance portion of electric conductor hold section 154c of electric conductors 131 and 132 becomes large. If bending R becomes large, the overall length of a stator coil will become long and coil resistance will become large. Moreover, in case electric conductors 131 and 132 twist and it escapes from electric conductor hold section 154c of Fixtures 154a and 154b, in order to attach a blemish to electric conductors 131 and 132, a blemish arises also into portions other than the electric conductor edge used as a joint.

[0005] Moreover, the twist equipment of an armature coil is shown by JP,60-241748,A. With the twist equipment of this armature coil, since it is possible to move not only to a hoop direction but to shaft orientations, the twist fixture which twists an electric conductor can prevent that an electric conductor falls out and bending R of an electric conductor becomes large with rotation of a twist fixture.

[0006] In case a coil is fabricated, in order to prevent that the electric conductors by the side of inner circumference and a periphery contact and short-circuit except a joint, it is necessary to prepare a crevice between electric conductors. In above-mentioned JP,60-241748,A, in order to form the crevice between electric conductors, a salient is inserted between electric conductors, between internal and external electric conductors is extended, and the crevice is formed. And after forming a crevice, an electric conductor edge is twisted, it inserts in a fixture, and the twist is added to the electric conductor. Therefore, although the short circuit between internal and external electric conductors can be prevented, a blemish occurs in the latus range of the contact section with a salient at an electric conductor.

[0007] Moreover, in above-mentioned JP,60-241748,A, the twist orbit of a hoop direction and shaft orientations is determined by the cam fixed to the twist fixture. Therefore, in order to change a twist orbit, the whole twist fixture needed to be exchanged. this invention is made in view of the above-mentioned problem, and it aims at offering the stator manufacturing installation and the manufacture method of an overall length that a short stator coil can be manufactured.

[0008] Moreover, this invention aims at offering the stator manufacturing installation which twists an electric conductor, without giving a blemish other than the joint of an electric conductor. Moreover, this invention aims at offering the stator manufacturing installation which can operate the nose of cam of an electric conductor orthopedically in the configuration of having been suitable for joining them.

Moreover, this invention aims at change of the orbit of the twist of the electric conductor by the twist fixture offering an easy stator manufacturing installation.

[0009]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, in invention according to claim 1 In the stator manufacturing installation which twists two or more electric conductors (3, 31, 32) which begin to be prolonged in accordance with shaft orientations from the end face of an annular stator core (1) The edge (31d, 31e, 32d, 32e) of an electric conductor (3, 31, 32) is held. a stator-core (1) and same axle top relatively [ shaft orientations / a hoop direction and ] The plastic surgery section which can move (54), It is characterized by having the hoop-direction mechanical component (541a-544a) which drives the plastic surgery section (54) to a hoop direction, and the shaft-orientations mechanical component (54a, 54b) which drives the plastic surgery section (54) to shaft orientations.

[0010] According to this, the plastic surgery section (54) is relatively [ shaft orientations / not only a hoop direction but ] movable to a stator core (1). That is, an electric conductor (3, 31, 32) can be twisted, preventing that an electric conductor (3, 31, 32) falls out from the portion into which the plastic surgery section (54) holds the edge (31d, 31e, 32d, 32e) of an electric conductor (3, 31, 32) to a stator core (1) since [ three dimensions ] it can move-like. Therefore, since bending R of an electric conductor (3, 31, 32) can be made small and the overall length of a stator coil can be shortened, coil resistance can be made small.

[0011] Moreover, since an electric conductor (3, 31, 32) does not escape from the plastic surgery section (54), it can prevent that a blemish sticks in addition to the edge (31d, 31e, 32d, 32e) of an electric conductor (3, 31, 32). In addition, since it is joined to the edge (31d, 31e, 32d, 32e) of other electric conductors (3, 31, 32) after a twist, the influence on the stator coil by the blemish does not have the edge (31d, 31e, 32d, 32e) of an electric conductor (3, 31, 32).

[0012] Furthermore, the plastic surgery section (54) is driven by the hoop-direction mechanical component (541a-544a) to a hoop direction, and is driven by the shaft-orientations mechanical component (54a, 54b) to shaft orientations. That is, since the drive to a hoop direction and shaft orientations is performed by the independent drive, respectively, in order to change the orbit of the twist of the electric conductor (3, 31, 32) by the plastic surgery section (54), it becomes possible by change of either a hoop-direction mechanical component (541a-544a) or a shaft-orientations mechanical component (54a, 54b).

[0013] In invention according to claim 2, two or more layers are formed in the direction of a path in a slot (2), the plastic surgery section (54) is arranged on the same axle, and the electric conductor (3, 31, 32) is characterized by having relatively two or more twists fixture (541-544) which can rotate. Thereby, the optimal twist can be added to two or more each class from which a coil diameter is different.

[0014] In invention according to claim 3, it is characterized by the ability to rotate a twist fixture (541-544) in any direction of a hoop direction. Since a twist fixture (541-544) can rotate in any direction of a hoop direction, after adding the twist more than a predetermined angle to an electric conductor (3, 31, 32), operation of returning to a predetermined angle can be used as a twist fixture (541-544).

Deformation by the springback of a coil can be prevented by carrying out such an operation.

[0015] In invention according to claim 4, to two or more twist fixtures (541-544) the attaching part (541b --) which the edge (31d, 31e, 32d, 32e) of an electric conductor (3, 31, 32) is inserted, and holds an electric conductor (3, 31, 32) The attaching part which 542b, 543b, and 544b are drilled, and was drilled by the twist fixture (541-544) of 1 (541b, 542b, 543b, 544b), It is characterized by having the septum (541c-544c, 542d, 543d) which prevents a free passage with the attaching part (541b, 542b, 543b, 544b) formed in other twist fixtures (541-544) which adjoin in the twist fixture (541-544) and the direction of a path of 1.

[0016] In invention according to claim 5, moreover, two or more twist fixtures (541-544) Adjoin in the direction of a path and the twist fixture (541-544) of a \*\*\*\*\* couple is included. The septum (541c-544c) located between the attaching parts (541b, 542b, 543b, 544b) of the twist fixture (541-544) of these couples the attaching part (541b --) of two twist fixtures (541-544) which does not make a pair although it adjoins in the direction of a path It is characterized by having thickness smaller than the septum (542d, 543d) located between 542b, 543b, and 544b. in invention according to claim 6 Two or more twist fixtures (541-544) are characterized by having two or more pairs of twist fixtures (541-544) which adjoin in the direction of a path.

[0017] The edge (31d, 31e, 32d, 32e) of the electric conductor (3, 31, 32) which came out of the slot (2) is held by the attaching part (541b, 542b, 543b, 544b) drilled by each twist fixture (541-544). And the septum which prevents the free passage between adjoining attaching parts (541b, 542b, 543b, 544b) is prepared in each twist fixture (541-544). The thickness of this septum adjoins in the direction of a path of two or more twist fixtures (541-544), and although it adjoins between \*\*\*\*\* twist fixtures (541-544), it is made to become smaller than between the twist fixtures (541-544) which do not make a pair. For example, when [ to require ] the plastic surgery section (54) is formed from the twist fixture (541-544) of four layers and the 1st layer, a two-layer eye and the 3rd layer, and the 4th layer form the pair the attaching part (541b --) drilled by the twist fixture (541 542) of a two-layer eye with the 1st layer from the inner layer side Thickness is small set up rather than the septum between the attaching parts (542b, 543b) in which the septum between the attaching parts (543b, 544b) drilled by the septum between 542b and the twist fixture (543 544) of the 3rd layer and the 4th layer was drilled by the two-layer eye and the twist fixture (542 543) of the 3rd layer.

[0018] Since the septum which prevents the free passage of each attaching part (541b, 542b, 543b, 544b) is prepared, a crevice can be made between each electric conductor (3, 31, 32). For this reason, it can prevent that between each electric conductor (3, 31, 32) contacts and connects too hastily. The twist fixture (541 542) of the 1st layer and a two-layer eye, and the twist fixture (543 544) of the 3rd layer and the 4th layer by moreover, the thing made for a hoop-direction retrose to carry out predetermined angle rotation, respectively The crevice between the 1st layer, a two-layer eye, and the electric conductor (3, 31, 32) of the 3rd layer and the 4th layer can be made to approach from the crevice between a two-layer eye and the electric conductor (3, 31, 32) of the 3rd layer. Thereby, it can be made to be able to approach between the electric conductors to join (i.e., between the 1st layer, a two-layer eye, and the electric conductor of the 3rd layer and the 4th layer), and they can make a junction process easy.

[0019] By invention according to claim 7, it is characterized by having further the controller (55) which controls operation with a hoop-direction mechanical component (541a-544a) and a shaft-orientations mechanical component (54a, 54b), and the controller (55) is characterized by rotating relatively the aforementioned twist fixture (541-544) which adjoins in the direction of a path by invention according to claim 8.

[0020] According to this, since the rotation and the amount of rise and fall of a hoop-direction mechanical component (541a-544a) and a shaft-orientations mechanical component (54a, 54b) are controlled by the controller (55), the change of the amount of twists of them is easily attained by

changing the control program in a controller (55). Since the rotation of each twist fixtures 541, 542, 543, and 544 can be mutually controlled independently and the amount of rise and fall can be controlled independently with those rotations, suitable twist processing can be added also in various stators.

[0021] In invention according to claim 9, to the annular stator core (1) in which many slots (2) were prepared together with the hoop direction The segmented electric conductor (3, 31, 32) is arranged so that two or more layers may be formed in the direction of a path in the aforementioned slot (2). To the bay of the electric conductor (3, 31, 32) which has come out of the aforementioned slot (2) by the side of one edge of a stator core (1) The edge of an electric conductor (3, 31, 32) is held preparing the electric conductor (3, 31, 32) and crevice which adjoin in the direction of a path. To a stator core (1), it moves relatively [ shaft orientations / a hoop direction and ], twists, and is characterized by joining and flowing through the edges (31d, 31e, 32d, 32e) of an electric conductor (3, 31, 32).

[0022] Since it is twisting by this, moving an electric conductor (3, 31, 32) not only to a hoop direction but to shaft orientations, and bending R of an electric conductor (3, 31, 32) can be made small and the overall length of a stator coil can be shortened, coil resistance can be made small. Moreover, since a crevice is formed between the electric conductors (3, 31, 32) which adjoin in the direction of a path, it can prevent that adjoining electric conductors (3, 31, 32) contact and short-circuit.

[0023] In addition, the sign in the above-mentioned parenthesis shows a correspondence relation with a concrete means given in an operation gestalt to mention later.

[0024]

[Embodiments of the Invention] Hereafter, the operation gestalt which shows this invention in drawing is explained. The stator manufacturing installation of the AC generator for vehicles concerning the operation gestalt of this invention is explained based on drawing 7 from drawing 1. The perspective diagram in which drawing 1 shows the insertion process of the segment to a stator core, the perspective diagram of a segment by which a stator core is equipped with drawing 2, and drawing 3 are the cross sections showing the hold state of the segment within a slot. The stator of the AC generator for vehicles of this operation gestalt consists of insulating films 4 which carry out electric insulation of between the annular stator core 1, the stator coil formed with the electric conductor 3 arranged in the slot 2 formed in the stator core 1, and stator cores 1 and electric conductors 3.

[0025] Two or more slots 2 are formed in the stator core 1 together with the hoop direction so that the stator coil of a polyphase can be held. With this operation gestalt, 36 slots 2 are arranged at equal intervals so that the stator coil of a three phase circuit may be held. The electric conductor 3 arranged at the slot 2 of a stator core 1 can be grasped as 1 one segment formed in the shape of U character. The segment of the shape of this U character has the large segment 31 as shown in drawing 2, and two kinds of small segments 32, and the edges 31d and 31e of the large segment 31 and the edges 32d and 32e of the small segment 32 have become taper-like. moreover, turn section 32c of the small segment 32 is surrounded by turn section 31c of the large segment 31, is made, and is arranged -- having -- an outer layer side -- a conductor -- Sections 31b and 32b -- the back side of a slot 2 -- a inner layer side -- a conductor -- the two sections 31a and 32a are simultaneously inserted in a slot 2 so that it may be located in a slot 2 opening side if it sees about one segment -- an outer layer side -- a conductor -- a section side and a inner layer side -- a conductor -- the section is inserted in the slot 2 which predetermined pole-pitch T (this operation gestalt three slots) separated That is, outer layer side hold section 31b of the large segment 31 and inner layer side hold section 31a are inserted in the slot 2 which predetermined pole-pitch T Separated, and outer layer side hold section 32b of the small segment 32 and inner layer periphery side hold section 32a are similarly inserted in the slot 2 which predetermined pole-pitch T Separated. Thus, by inserting an electric conductor 3 in each slot 2, as shown in drawing 3, an electric conductor 3 makes four layers in the direction of a path within one slot 2, and is arranged at one train.

[0026] After arranging an electric conductor 3 into each slot 2, each class is twisted for the bay of the segment which came out from the end of a slot 2 by the circumference direction retrose a half-pole pitch (T/2) by turns with the stator-coil twist equipment 5 which mentions a detail later. That is, at this operation gestalt, the electric conductor 3 of the 1st layer from a inner layer side and the 3rd layer is

seen from a nose of cam, and 1.5 slot \*\*\*\*\*, a two-layer eye, and the electric conductor 3 of the 4th layer are 1.5 slot \*\*\*\*\* to the direction of a clockwise rotation in the direction of a counterclockwise rotation. The sense of the twist of this each class is the same over stator-core 1 perimeter, therefore the electric conductor 3 inclines in the same direction over a perimeter within each class.

[0027] After twisting each electric conductor 3 to a hoop direction, it is joined so that the edges which the 1st layer, the two-layer eye, and the electric conductor 3 of the 3rd layer and the 4th layer adjoined may obtain an electric flow from a inner layer side using TIG arc welding, low attachment, resistance welding, electron beam welding, laser welding, etc., and the stator coil of a three phase circuit is formed. Next, the stator-coil twist equipment 5 which twists the bay of the electric conductor 3 which came out from the slot 2 to a hoop direction is explained.

[0028] It is an A-A cross-section view view [ in / drawing 4 / drawing 4 , and / in drawing 5 ]. / typical drawing of longitudinal section of the stator-coil twist equipment 5 of this invention Stator-coil twist equipment 5 The movement of the work receptacle 51 which receives the periphery section of a stator core 1, and the direction of a path of a stator core 1 is regulated. Shaft 54 for rise and fall a for driving the twist plastic surgery section 54 for twisting the bay of the clammer 52 to hold, the work presser foot 53 which prevents the relief of a stator core 1, and the electric conductor 3 which came out of the end of a stator core 1, and the twist plastic surgery section 54 to shaft orientations, It has the controller 55 which controls rise-and-fall drive 54b for moving the rotation drives 541a-544a and shaft 54a for rise and fall which carry out the rotation drive of the twist plastic surgery section 54 at a hoop direction to shaft orientations, and the rotation drives 541a-544a and \*\*\*\*\* 54b, and is constituted.

[0029] The twist fixtures 541-544 of the four shape of a cylinder arranged in the shape of the said heart arrange those apical surfaces, and the twist plastic surgery section 54 is arranged, and is constituted. With the rotation drives 541a-544a, each twist fixtures 541-544 can be rotated independently of a hoop direction. Moreover, four twist fixtures 541-544 can be simultaneously gone up and down by going up and down shaft 54a for rise and fall by rise-and-fall drive 54b.

[0030] The electric conductor insertion sections 541b-544b by which the edges 31d, 31e, 32d, and 32e of an electric conductor 3 are inserted and held are drilled in the apical surface of each twist fixtures 541-544 as shown in the cross section of drawing 5 . These electric conductor insertion sections 541b-544b arrange in the hoop direction of each twist fixtures 541-544 only a number equal to the slot 2 formed in the stator core 1, and are formed. The septa 541c-544c for these electric conductor insertion sections 541b-544b preventing the free passage of the electric conductor insertion sections 541b-544b which adjoin in the direction of a path, and 542d and 543d are prepared. In addition, these septa 541c-544c and thickness (542d and 543d) Rather than the interval d3 formed by the interval d1 formed by the septa 541c and 542c between the 1st layer and a two-layer eye, and the septa 543c and 544c between the 3rd layer and the 4th layer, it is set up so that the interval d2 formed by the septa 541d and 542d between a two-layer eye and the 3rd layer may become large.

[0031] Next, the operation of stator-coil twist equipment 5 is explained. The stator core 1 by which the electric conductor 3 has been arranged in a slot 2 is set to the work receptacle 51. And the periphery section of a stator core 1 is fixed by the clammer 52. Then, the movement of a stator core 1 and the vertical direction of an electric conductor 3 is regulated by pressing down turn section 31c of the upper part of a stator core 1, and the large segment 31 by the work presser foot 53.

[0032] After the stator core 1 by which the electric conductor 3 has been arranged is fixed by a clammer 52 and the work presser foot 53, it twists by shaft 54a for rise and fall, the plastic surgery section 54 goes up, and the edges 31d, 31e, 32d, and 32e of an electric conductor 3 are inserted in the electric conductor insertion sections 541b-544b formed in each twist fixtures 541-544. In addition, only the length which is the edges 31d, 31e, 32d, and 32e of electric conductor 3 \*\*, and serves as a joint behind can be inserted in the electric conductor insertion sections 541b-544b. Moreover, since the edges 31d, 31e, 32d, and 32e of an electric conductor 3 are formed in the shape of a taper, they are smoothly inserted in the electric conductor insertion sections 541b-544b.

[0033] After the edges 31d, 31e, 32d, and 32e of an electric conductor 3 twist and being inserted in the electric conductor insertion sections 541b-544b of the plastic surgery section 54, the twist plastic

surgery section 54 rotates and goes up and down by the rotation drives 541a-544a and rise-and-fall drive 54b. In addition, as for rise and fall of the twist plastic surgery section 54, all the twist plastic surgery sections 541-544 are performed simultaneously. Moreover, about rotation of the twist plastic surgery section 54, it twists with the twist fixture 541, and a fixture 543 rotates only a corresponding phase in the direction of a clockwise rotation, it twists with the twist fixture 542, and a fixture 544 rotates only a corresponding phase in the direction of a counterclockwise rotation.

[0034] Drawing 6 is drawing showing the timing of rise and fall and rotation of the twist fixtures 541-544. First, a controller 55 controls the rotation drives 541a-544a for the predetermined angle  $\theta_1$  to perform only rotation of the twist plastic surgery section 54. It bends to the electric conductor 3 of the outlet portion of a slot 2, and the entrance portion of the electric conductor insertion sections 541b-544b, and R is attached by rotation of this predetermined angle.

[0035] Then, it is made to go up, controlling rise-and-fall drive 54b and the rotation drives 541a-544a by the controller 55, twisting them, and rotating the plastic surgery section 54 about an electric conductor 3, so that the length of the outlet portion of a slot 2 and the entrance portion of the electric conductor insertion sections 541b-544b may be kept constant. Under the present circumstances, it goes up, rotating so that the edges 31d, 31e, 32d, and 32e of an electric conductor 3 may draw circular tracing. The twist describing this circular tracing is performed to an angle  $\theta_2$  exceeding the angle  $\theta_3$  which is a half-pole pitch ( $T/2$ ), in order to prevent deformation of the electric conductor 3 by the springback. In addition, in this process, although driven to H1 exceeding the amount H2 of processings of the convention not only to a hoop direction but shaft orientations, since the outlet portion of the slot 2 of an electric conductor 3 is already bent, an electric conductor 3 goes up, the twist plastic surgery sections 541-544 escape from a slot 2, and it does not come out of them.

[0036] Then, the tracing top same to the position of an angle  $\theta$  and the amount H2 of rise and fall is returned by considering descent as a last process and rotation of a retrose. Thus, the twist of an electric conductor 3 is ended, it descends, the twist plastic surgery section 54 is twisted, and the edges 31d, 31e, 32d, and 32e of an electric conductor 3 are removed from the electric conductor insertion sections 541b-544b of fixtures 541-544. The twist plastic surgery section 54 by which the electric conductor 3 was removed rotates with the rotation drives 541a-544a, and is returned to a original position.

[0037] Finally, a clamper 52 and the work presser foot 53 are removed, and the stator in the state where the twist was added to the electric conductor 3 as shown in drawing 7 is taken out. Then, the stator coil of a three phase circuit which joined the adjacent edges 31d, 31e, 32d, and 32e, and had the necessary number of turns is formed. In addition, the manufacture method of the stator by the stator manufacturing installation stated above is shown in the flow chart of drawing 8.

[0038] That is, the process which inserts two or more segments 31 and 32 in a stator core 1 from shaft orientations is performed after the process which manufactures two or more segments 31 and 32, and the process which manufactures a stator core 1 by the laminating of a plate, an above-mentioned twist process is performed, and the junction process which joins the points 31d, 31e, 32d, and 32e of a segment is performed. In a segment manufacturing process, a wire rod is processed and two or more segments 31 and 32 are manufactured. Two or more segments 31 and 32 are regularly put with an insertion process in the slot 2 of a stator core 1. In addition, at this insertion process, the method of inserting in a stator core 1, after arranging segments 31 and 32 beforehand, and the method of inserting segments 31 and 32 in a stator core 1 in order can be chosen.

[0039] A twist process equips the equipment of drawing 4 with a stator with a segment, inserts the edge of an electric conductor in a fixture, and includes the wearing process which makes the preparations before twist processing, the plastic surgery process the operation is indicated to be to drawing 6, and the extraction process which takes out the stator operated orthopedically. Make only a hoop direction carry out the rotation variation rate of the edge of an electric conductor to a plastic surgery process first (from (0 of drawing 6, and 0) to ( $\theta_1$  and 0)), and an electric conductor is pushed down on a hoop direction here. Then, the bending process which shaft orientations are made to carry out the variation rate of the edge of an electric conductor to a hoop-direction row (from ( $\theta_1$  of drawing 6, and 0) to ( $\theta_3$ , H2)), and leans an electric conductor deeply, The excess bending process of making shaft orientations

carrying out the variation rate of the edge of an electric conductor to a hoop-direction row exceeding the further predetermined amount of processings (from  $(\theta_3, H_2)$  to  $(\theta_2, H_1)$  of drawing 6), and leaning an electric conductor deeply superfluously, The return process which returns the edge of an electric conductor to the predetermined amount of processings (from  $(\theta_2, H_1)$  to  $(\theta_3, H_2)$  of drawing 6) is included.

[0040] With this operation gestalt, the twist plastic surgery section 54 can be displaced relatively not only to a hoop direction but to shaft orientations to a stator core 1. That is, the twist plastic surgery section 54 can move in three dimensions to a stator core 1. Therefore, it can prevent that an electric conductor 3 escapes from and comes out of the electric conductor insertion sections 541b-544b about an electric conductor 3 since it can twist so that the length of the outlet portion of a slot 2 and the entrance portion of the electric conductor insertion sections 541b-544b may be kept constant, and the edges 31d, 31e, 32d, and 32e of an electric conductor 3 may draw circular tracing. Therefore, bending R of an electric conductor 3 can be made small, and the overall length of a stator coil can be shortened, it can accumulate, and resistance of a stator coil can be made small.

[0041] Moreover, with this operation gestalt, as mentioned above, only the edges 31d, 31e, 32d, and 32e of an electric conductor 3 are inserted in the electric conductor insertion sections 541b-544b, and it does not come [ an electric conductor 3 escapes from them and ] out of the electric conductor insertion sections 541b-544b. Therefore, it can prevent that a blemish sticks in addition to the edges 31d, 31e, and 32d of an electric conductor 3, and 32e. In addition, since it is joined to the edges 31d, 31e, 32d, and 32e of other electric conductors 3 after a twist, the influence on the stator coil by the blemish does not have the edges 31d, 31e, 32d, and 32e of an electric conductor 3.

[0042] Moreover, with this operation gestalt, each twist fixtures 541-544 can be rotated independently a hoop direction. Therefore, it becomes possible to add the optimal twist to two or more layers from which the coil diameter formed in a slot 2 differs. Moreover, each twist fixtures 541-544 can be returned to the position of a half-pole pitch, after making it rotate more than a half-pole pitch, since it can rotate in any direction of a hoop direction. This becomes possible to prevent deformation by the springback of a coil.

[0043] Moreover, with this operation gestalt, rather than the septa 541c and 542c between the 1st layer and a two-layer eye, and the septa 543c and 544c between the 3rd layer and the 4th layer, 541d of septa between the 3rd layer and the 4th layer, Septa 541c-544c and thickness (542d and 543d) are set up so that 542d may become large. if half-pole pitch rotation of the 1st layer, a two-layer eye and the 3rd layer, and the 4th layer is carried out at an opposite direction, respectively -- the 1st layer, a two-layer eye, and the potential of the 3rd layer and the 4th layer -- a conductor 3 approaches mutually On the other hand, since, as for a two-layer eye and the electric conductor insertion sections 542b and 543b of the 3rd layer, Septa [ 542d and 543d ] thickness is set up greatly, the crevice between a two-layer eye and the electric conductor 3 of the 3rd layer becomes large. A crevice can be enlarged between the electric conductors of the 3rd layer and the 4th layer which it can be made by this to approach between the electric conductors to join (i.e., between the 1st layer, a two-layer eye, and the electric conductor of the 3rd layer and the 4th layer), and are not joined, and it can make a junction process easy.

[0044] In addition, with this operation gestalt, the twist fixtures 541 and 543 rotated the direction of a clockwise rotation, and the twist fixtures 542 and 544 counterclockwise. However, even if it makes the above-mentioned operation gestalt and opposite direction rotate each twist fixtures 541-544 and twists an electric conductor 3, it is possible to form a stator coil similarly. Moreover, it can respond to various stators by exchanging the twist fixtures 541, 542, 543, and 544. For example, it can respond by exchange of the twist fixtures 541, 542, 543, and 544 also to a stator not only with the stator of 36 slots but more numbers of slots, such as 48, 84, and 96. And since the rotation of each twist fixtures 541, 542, 543, and 544 can be mutually controlled independently and the amount of rise and fall can be controlled independently with those rotations, suitable twist processing can be added also in various stators.

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[Translation done.]

## \* NOTICES \*

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DESCRIPTION OF DRAWINGS

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## [Brief Description of the Drawings]

[Drawing 1] It is the perspective diagram showing the insertion process of the segment of the operation gestalt of this invention.

[Drawing 2] It is the partial cross section of the stator of an operation gestalt.

[Drawing 3] It is the perspective diagram of the segment of an operation gestalt.

[Drawing 4] It is drawing of longitudinal section of the stator-coil twist equipment of an operation gestalt.

[Drawing 5] It is the front view of the twist fixture of an operation gestalt.

[Drawing 6] It is the operation view of the twist plastic surgery section of an operation gestalt.

[Drawing 7] It is the partial perspective diagram of the coil end of the stator after the segment twist of an operation gestalt.

[Drawing 8] Flow chart \*\*\*\* which shows the manufacture procedure of an operation gestalt.

[Drawing 9] It is the cross section of a stator showing arrangement of the electric conductor within the slot of the conventional technology.

[Drawing 10] It is the \*\* type view showing the situation of the twist of the electric conductor by the twist fixture of the conventional technology.

## [Description of Notations]

1 [ -- A work receptacle, 52 / -- A clumper, 53 / -- A work presser foot, 54 / -- The twist plastic surgery section, 541-544 / -- A twist fixture, 541a-544a / -- A rotation drive, 54a / -- The shaft for rise and fall, 54b / -- A rise-and-fall drive, 55 / -- Controller. ] -- A stator core, 3 -- An electric conductor, 51

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[Translation done.]

\* NOTICES \*

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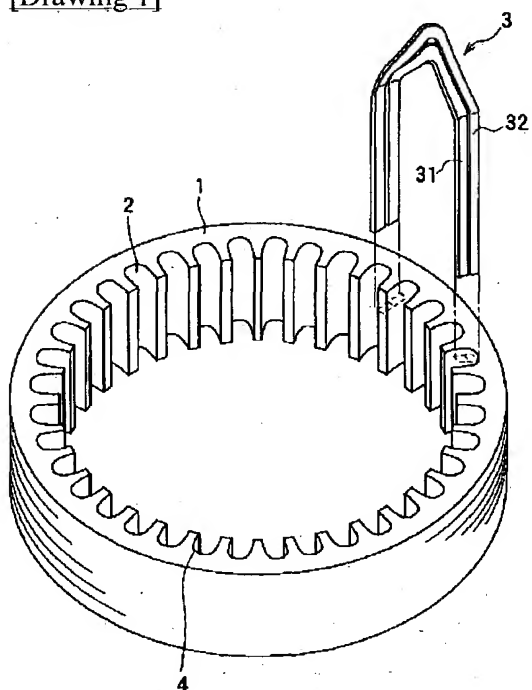
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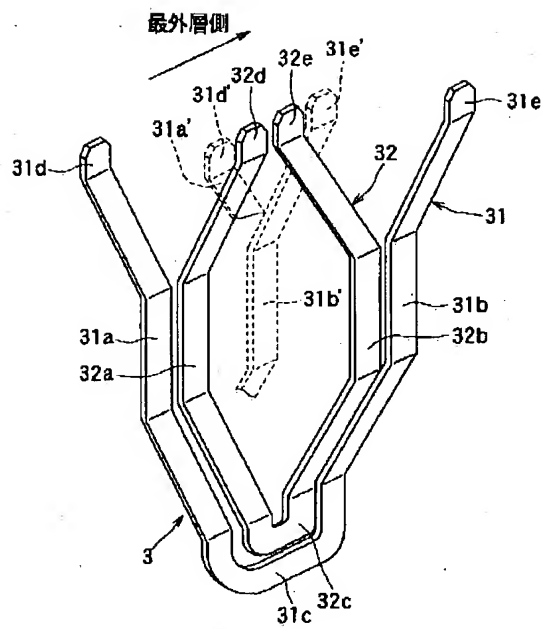
DRAWINGS

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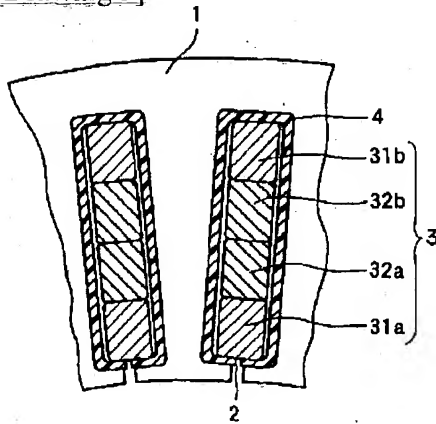
[Drawing 1]



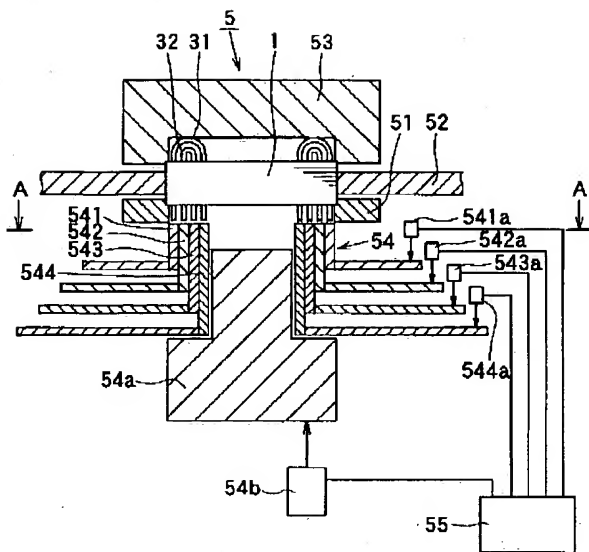
[Drawing 2]



[Drawing 3]

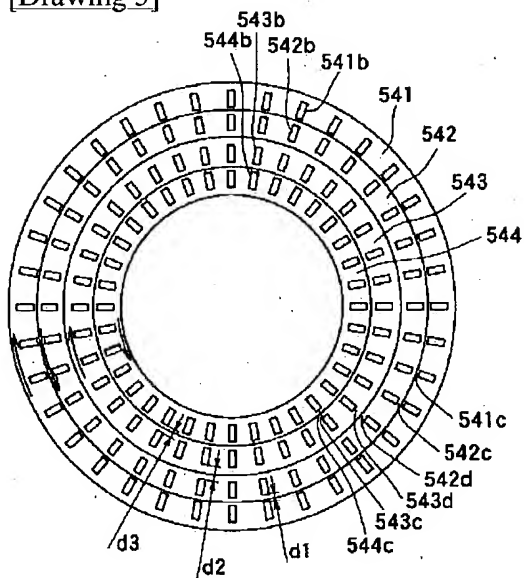


[Drawing 4]

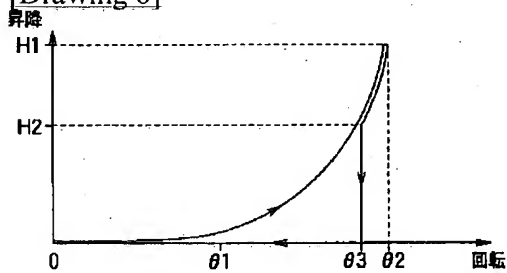


- |               |                   |
|---------------|-------------------|
| 1:ステータコア      | 541~544: 捻り治具     |
| 5:ステータコイル捻り装置 | 541a~544a: 回転駆動機構 |
| 51:ワーク受け      | 54a: 昇降用シャフト      |
| 52:クランパ       | 54b: 昇降駆動機構       |
| 53:ワーク押さえ     | 55: コントローラ        |
| 54: 捻り整形部     |                   |

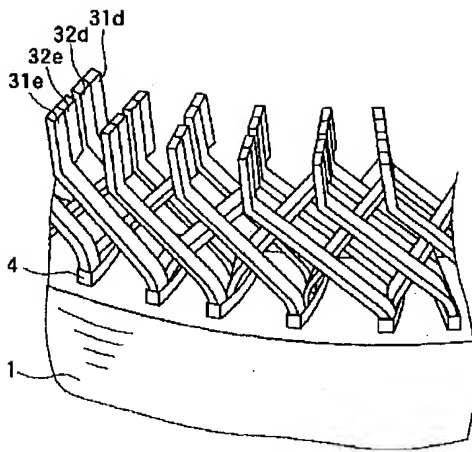
[Drawing 5]



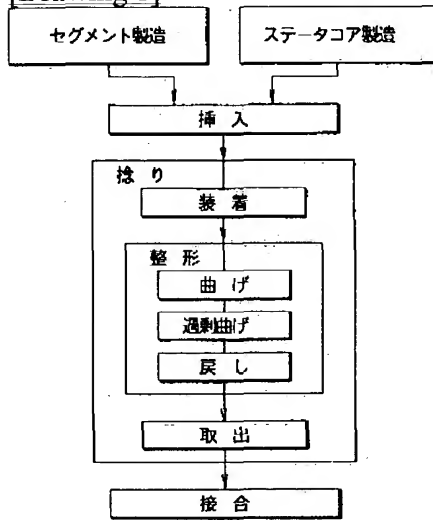
[Drawing 6]



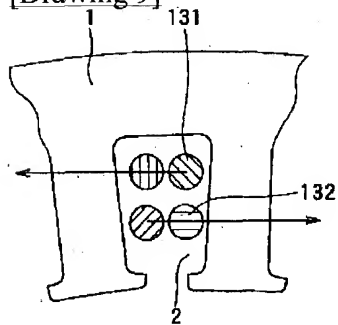
[Drawing 7]



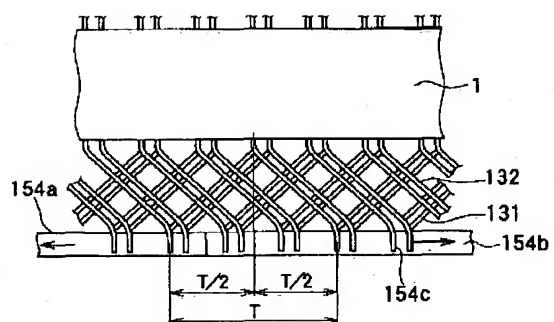
[Drawing 8]



[Drawing 9]



[Drawing 10]



[Translation done.]

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## Abstract

PROBLEM TO BE SOLVED: To provide a stator manufacturing apparatus which can manufacture a stator coil whose total length is short.

SOLUTION: A stator is featured in such a way that end parts 31d, 31e, 32d, 32e of electric conductors 3, 31, 32 which protrude from the end part of a stator core 1 on one side are held, and that a twist restoring part 54 which can be moved relatively to the circumferential direction and the axial direction of the stator core 1 is provided. Since the twist restoring part 54 can be moved three-dimensionally with reference to the stator core 1, it is possible to prevent the electric conductors 3, 31, 32 from being pulled out from parts in which the end parts 31d, 31e, 32d, 32e of the electric conductors 3, 31, 32 are held, and the electric conductors 3, 31, 32 can be twisted. As a result, the bending R of the electric conductors 3, 31, 32 can be reduced, the total length of a stator coil can be made short, and a coil resistance can be reduced.